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ABSTRACT

The research project "Feedback Processes in Computer Managed Spelling Instruction" is aimed at developing and testing an instructional software program for teaching the orthography of Dutch verbs. The main focus of this paper is on how to design an optimal educational environment. The design of the man-computer interaction is highlighted from a number of aspects: the sequencing of the learning content, the presentation of information on the screen, and the format of student input and feedback. The program consists of seven instructional modules, each focusing on a grammatical operation such as grammatical tense, person, number and voice. Two versions of the program, a Standard Version and a Flexible Version, were field tested and the results were compared, taking account of individual differences in spelling ability and motivation variables. Results indicated that no strong interactions between treatment variables and student characteristics could be established; however, on the whole, the software proved to be effective. (6 references) (Author/DB)

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Computer Controlled Spelling Instruction

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Computer Controlled Spelling Instruction:

A Case Study in Courseware Design

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Abstract

The research project 'Feedback Processes in Computer Managed Spelling Instruction' is aimed at developing and testing an instructional software program for teaching the orthography of Dutch verbs. The main focus of this paper is on how to design an optimal learning environment. The design of man-computer interaction is highlighted from a number of respects: the sequencing of the learning content, the presentation of information on the screen and the format of student input and feedback. The program consists of seven instructional modules. In each module a specific grammatical operation, such as grammatical tense, person, number and voice, is highlighted. In a field experiment the effectiveness of the courseware was tested. Two versions of the program, a Standard Version, and a Flexible Version, were compared, taking account of individual differences in spelling ability and motivation variables. Results with both versions are reported.

This paper reports on the research project 'Feedback Processes in Computer Managed Spelling Instruction', financially supported by the Dutch National Foundation for Educational Research. The project was aimed at designing and testing a courseware program for teaching the rules of verb orthography. This topic is the hard core of the spelling curriculum, since all orthographic rules applicable in Dutch coincide here. We will focus here on basic issues concerning the design of the interface in our program.

The major difficulty of Dutch verb spelling is that the existing system of orthographic rules produces a large proportion of homophones. Homophones are words with coinciding acoustic forms. Most homophones are distinguished in print by different spellings (e.g. son/sun, hair/hare). Homophones may be semantically or grammatically defined. In English, most homophones have different word meanings. In other languages, however, such as in French and in Dutch, homophones expressing grammatical distinctions also are very frequent.

In Dutch spelling, grammatically defined homophones express several grammatical functional distinctions, such as grammatical tense, person, aspect, number and voice (active/passive). To illustrate, compare Dutch 'ik vind/hij vindt' (I find/he finds), a purely orthographic, homophonic distinction in grammatical person (1st vs 3rd). Other examples are wachten/wachtten (wait/waited), gebeurt/gebeurd (happens/happened) and verbrandde/verbrande (burned/burnt). Knowledge of these kinds of grammatical distinctions is a prerequisite for making correct orthographic decisions.

Recently, an instructional method based on new insights from instructional psychology was developed (Assink, 1987a). Essential to this method is a spelling algorithm for writing verbs correctly. In two large-scale field experiments, this algorithmic teaching method proved to produce superior results compared with the conventionally and commonly used analogy approach (Assink, 1987a; Zuidema, 1988). The design of this algorithm was mainly inspired by the work of Landa (1976; 1983). In the algorithm, a sequence of dichotomous decision problems is presented to the student. Each dichotomous decision problem confronts the student with a choice between a pair of relevant grammatical concepts. Consequently, the algorithm can be subdivided into a series of grammatical oppositions such as present vs. past tense, singular vs. plural verb form, etc. If the right choices are made this will automatically lead to the correct spelling rule. Thus, the grammatical operations constitute the most basic components of the algorithm. The algorithm presents the student with the complete system of concepts and rules that are relevant in the spelling of Dutch verbs. The algorithm of course, has to be introduced in a carefully planned way.

The algorithmic approach is well suited for courseware development. When designing courseware one should avoid producing 'electronic page turners'. The unique features of the computer as instructional medium should be fully exploited. The most striking feature of the courseware program is the way the learning content is structured. Contrary to textbook conventions, the computer program starts with introducing the spelling algorithm. The algorithm is divided into a discrete number of subalgorithms, mapping specific grammatical operations. At first, the

program deals with each grammatical operation separately. Subsequently, these isolated parts are integrated and combined with the grammatical operations that have already been dealt with in the course.

The program consists of seven instructional modules. In each module a specific grammatical operation, such as grammatical tense, person, number and voice, is highlighted. Empirical research has shown that grammatical operations may be ordered conceptually along a concrete--abstract dimension (Assink, 1987b). In the program, the grammatical operations are sequenced according to this continuum. Basic operations are presented in the introductory modules: identifying different verb forms, the subject and the finite verb in a sentence, further on more abstract operations follow. When the student is practicing verb spellings the (relevant part of) the algorithm appears on the screen. By way of a gradual decrease of the verbal and visual support presented on the screen, the algorithm is internalized by the student.

In a field experiment the effectiveness of the courseware was tested. Two versions of the program, a Standard Version, and a Flexible Version, were compared, taking account of individual differences in spelling ability and motivation variables. In the Standard Version, instruction and feedback was uniform, in the Flexible Version students could choose shorter instructional routes. Poor spellers were expected to perform better with the Standard Version, whereas good spellers were assumed to do better with the Flexible program. A similar interaction hypothesis with regard to motivation was formulated.

Method

Design

Eighty-eight 7-th grade elementary school students, selected from 8 different schools, participated in the experiment. The Ss. were selected on their scores on standard tests for Spelling Ability and Negative Fear of Failure (Hermans, 1971). According to their test scores, Ss. were selected and assigned to the two instructional conditions. This resulted in a $2 \times 2 \times 2$ mixed factorial design with the factors Instruction (standard/flexible), Spelling Ability (poor/good) and Motivation (high/low).

Procedure

The experiment was conducted in the period of november 1988 to july 1989. Ss. were instructed with the courseware program individually once a week in sessions of 45 minutes. In order to minimize confounding effects of 'man made' teacher instruction an agreement was made that the participating Ss. were excluded from class spelling instruction sessions.

Results

Posttest scores and amount of instruction time needed were used as dependent measures in the data analysis. MANOVAS were used to process the data. The effects were evaluated for each module seperately. A comparison between the pretest scores and the results on the posttests evaluating the students' results on the individual modules of the course showed significant improvements on all modules.

As expected, aptitude variables turned out to interact with learning outcomes. To illustrate, good spellers performed better in module 3 (spelling finite forms in the present tense), a topic demanding command

of orthographic skills $F(1,68)=9.34$, $p<.01$ (89% versus 81% correct, respectively). Poor spellers also needed significantly more instruction time here $F(1,68)=15.69$, $p<.001$ (262 minutes versus 187, respectively).

There were no strong interactions between learning outcomes and motivational variables. Ss. scoring high on Hermans' scale for Negative Fear of Failure needed more instruction time in modules 1 (basic concepts) and 2 (subject--finite form relationships) than Ss. with a low score on this scale. There were only substantial differences between the Standard and the Flexible Versions in module 1, $F(1,80)=6.13$, $p<.025$ (81% correct versus 71%, respectively). Poor spellers scoring high on the Negative Fear of Failure scale faced significantly more problems in assimilating the learning materials $F(1,80)=4.45$, $p<.05$. This group turned out to profit more from the Standard Version.

Learning gains of the complete course proved to be substantial. Mean test scores across modules ranged between 70% to 90% correct solutions. Comparison of posttest results with a paper-and-pencil pretest showed an over all average increase in spelling performance of thirty percent or more. A retention test, administered in the final week before the summer vacations produced a net average gain of twenty percent.

Discussion

One of the most noticeable outcomes of the experiment is that no strong and consistent interactions between treatment variables and student characteristics could be established. At this moment, the most plausible explanation we can give is that although the Flexible Version offers the student much more choice options with regard to his/her personal level of instruction, the highly structured character of the

subject matter taught throughout the program precluded poorly performing students to deviate substantially from his/her learning track.

In this connection it is noteworthy that individuals combining poor performance in spelling with high Negative Fear of Failure experienced most problems during instruction. In the introductory modules, for example, this group clearly profited more from the Standard Version. Presumably this effect is produced by the complete instruction and feedback provided here.

On the whole, the designed courseware proved to be effective. The implication is that computers can be effective tools for teaching cognitive skills such as spelling ability and grammatical analysis. In our opinion courseware design for this type of learning content is particularly suitable. Computerized instruction will only be embraced by educational practice if teachers realize that adoption creates extra possibilities for teachers and pupils as well.

Author Identification Note

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References

- Assink, E.M.H. (1987a). Algorithms in Spelling Instruction: the Orthography of Dutch Verbs. Journal of Educational Psychology, Vol. 79, pp. 228-235.
- Assink, E.M.H. (1987b). De rol van grammaticale operaties bij het nemen van orthografische beslissingen. [The role of grammatical operations in orthographic decisions]. In Spektator, pp. 180-193.
- Hermans, H.J.M. (1971). Prestatiemotief en Faalangst in Gezin en Onderwijs. [Need of Achievement and Debilitating Anxiety at Home and in School]. Lisse: Swets & Zeitlinger.
- Landa, L.N. (1976). Instructional Regulation and Control: Cybernetics, Algorithmization, and Heuristics in Education. Englewood Cliffs, NJ: Educational Technology Publications.
- Landa, L.N. (1983). The Algo-Heuristic Theory of Instruction. In C.M.Reigeluth (Ed.) Instructional-Design Theories and Models: an Overview of their Current Status. Hillsdale, NJ: Lawrence Erlbaum Associates.
- Zuidema, J.J. (1988). Efficiënt spellingonderwijs. Een leer- en expertmodel voor het spellen. [Efficient Spelling Instruction. A Learning and Expert Model for Spelling]. Ph.D Dissertation. Utrecht University. Amersfoort: Acco Publications.